

CLAIMS

What is claimed is:

1. A polymer prepared by polymerizing one or more polymerizable components from an aqueous solution, said polymer having pores whose size primarily depends on the pH and water concentration of the solution, said pH and water concentration being controlled to yield an average pore size greater than 2 nm and a density greater than 0.1 g/cc.
2. The polymer according to claim 1 wherein said polymerizable components comprise a hydroxylated benzene and an aldehyde.
3. The polymer according to claim 2 wherein said hydroxylated benzene is resorcinol and said aldehyde is formaldehyde.
4. The polymer according to claim 3 wherein said pH is less than 6.5.
5. The polymer according to claim 3 wherein the molar ratio of formaldehyde to resorcinol is approximately 2.
6. The polymer according to claim 3 wherein additional water is added such that the weight ratio of the additional water to the resorcinol is between 0.0 and 2.0.
7. The polymer according to claim 3 wherein the average pore size after carbonization is between 2 and 50 nanometers.

8. The polymer according to claim 3 wherein the average pore size after carbonization is between 10 and 28 nanometers.
9. The polymer according to claim 3 wherein the formaldehyde is supplied as an approximately 37 weight percent aqueous solution.
10. The polymer according to claim 1 wherein said polymerizable components comprise an amine and an aldehyde.
11. The polymer according to claim 10 wherein the amine is melamine and the aldehyde is formaldehyde.
12. The polymer according to claim 1 wherein said polymerizable components comprise a urea and an aldehyde.
13. The polymer according to claim 12 wherein the urea is unsubstituted and the aldehyde is formaldehyde.
14. The polymer according to claim 1 wherein the polymer is a powder.
15. The polymer according to claim 1 wherein the polymer is monolithic.

16. The polymer of claim 1 having a surface area of 50 to 2000 m²/g.
17. The polymer according to claim 2 wherein the polymer is a powder.
18. The polymer according to claim 2 wherein the polymer is monolithic.
19. The polymer of claim 2 having a surface area of 50 to 2000 m²/g.
20. The carbon prepared by carbonization of the polymer according to claim 1, having a pore size greater than 2 nm and a density greater than 0.1 g/cc.
21. A carbon as described in claim 20 having a volumetric capacitance in a non-aqueous electrolyte of at least 20 F/cc, a density greater than 0.5 g/cc, and an average pore size greater than 10 nm.
22. The carbon according to claim 20 wherein the carbon has a conductivity of at least 10 Scm⁻¹.
23. The carbon according to claim 20 having a surface area of 50 to 2000 m²/g.
24. The carbon according to claim 20 wherein the carbon is monolithic.
25. The carbon according to claim 20 wherein the carbon is a powder.

26. The carbon of claim 20 having an average pore size between 2 and 50 nm.
27. The carbon of claim 20 having an average pore size between 10 and 28 nm.
28. The carbon prepared by carbonization of the polymer according to claim 2, having a pore size greater than 2 nm and a density greater than 0.1 g/cc.
29. A carbon as described in claim 28 having a volumetric capacitance in a non-aqueous electrolyte of at least 20 F/cc, a density greater than 0.5 g/cc, and an average pore size greater than 10 nm.
30. The carbon according to claim 28 wherein the carbon has a conductivity of at least 10 Scm^{-1} .
31. The carbon according to claim 28 having a surface area of 50 to 2000 m^2/g .
32. The carbon according to claim 28 wherein the carbon is monolithic.
33. The carbon according to claim 28 wherein the carbon is a powder.
34. The carbon of claim 28 having an average pore size between 2 and 50 nm.

35. The carbon of claim 28 having an average pore size between 10 and 28 nm.
36. A polymer prepared by polymerizing one or more polymerizable components from an aqueous solution, wherein said polymerizable components comprise a hydroxylated benzene and an aldehyde and no catalyst is added.
37. The polymer of claim 36 wherein the pH or water concentration or both are controlled to yield an average pore size greater than 2 nm and a density greater than 0.1 g/cc.
38. The carbon prepared by carbonization of the polymer according to claim 36, having a pore size greater than 2 nm and a density greater than 0.1 g/cc.
39. The carbon prepared by carbonization of the polymer according to claim 36, having a pore size between 10 nm and 28 nm and a density greater than 0.1 g/cc.
40. A method for preparing a mesoporous polymer, comprising the steps of:
- (a) providing a solution containing one or more polymerizable organic compounds whose polymerization rate depends on pH;
 - (b) controlling the average polymer particle size primarily by controlling the pH; and
 - (c) manipulating the pore size in the polymer primarily by adjusting the solvent concentration.

41. The method according to claim 40, further including the step of drying the porous polymer to produce a dried porous polymer.

42. A method for preparing a mesoporous carbon, comprising the steps of:

(a) providing a solution containing one or more polymerizable organic compounds whose polymerization rate depends on pH;

(b) controlling the average polymer particle size primarily by controlling the pH;

(c) manipulating the pore size in the polymer by adjusting the solvent concentration; and

(d) pyrolyzing the porous polymer to form a porous carbon.

43. The method according to claim 42, further including the step of activating the porous carbon so as to increase its capacitance when used with an electrolyte.

44. The method according to claim 42, further including the step of activating the porous carbon, wherein the activation is carried out at between 500°C and 1200°C.

45. The method according to claim 42, further including the step of controlling the composition of the solution so as to produce a mesoporous carbon having a pore size between 2 and 50 nm.

46. The method according to claim 42, further including the step of controlling the

composition of the solution so as to produce a mesoporous carbon having a pore size between 10 and 28 nm.

47. A capacitor, comprising:

at least two electrodes, at least one of said electrodes comprising a mesoporous carbon material produced according to claim 42; and

an electrolyte in contact with at least one of said electrodes.

48. The capacitor according to claim 47 wherein the electrolyte is a non-aqueous electrolyte.

49. The capacitor according to claim 47 wherein the electrolyte is an aqueous electrolyte.

50. The capacitor according to claim 47 wherein the carbon material is monolithic.

51. A mesoporous carbon prepared according to claim 42 with at least one dimension greater than 2 mm, a surface area between 200 and 2000 m²/g, a density greater than 0.5 g/cc, and a pore size greater than 10 nm.

52. The mesoporous carbon according to claim 51 having a conductivity of at least 10 Scm⁻¹.

53. A substrate for liquid chromatography comprising a polymer prepared by polymerizing one or more polymerizable components from an aqueous solution, said polymer having pores whose size primarily depends on the pH and water concentration of the solution, said pH and

water concentration being controlled to yield an average pore size greater than 4 nm and a density greater than 0.1 g/cc.

54. The substrate for liquid chromatography according to claim 53 wherein said polymerizable components comprise a hydroxylated benzene and an aldehyde.

55. The substrate for liquid chromatography according to claim 54 wherein said hydroxylated benzene is resorcinol and said aldehyde is formaldehyde.

56. A mesoporous catalyst support comprising a polymer prepared by polymerizing one or more polymerizable components from an aqueous solution, said polymer having pores whose size primarily depends on the pH and water concentration of the solution, said pH and water concentration being controlled to yield an average pore size greater than 2 nm and a density greater than 0.1 g/cc.

57. The mesoporous catalyst support according to claim 56 wherein said polymerizable components comprise a hydroxylated benzene and an aldehyde.

58. The mesoporous catalyst support according to claim 57 wherein said hydroxylated benzene is resorcinol and said aldehyde is formaldehyde.

59. A mesoporous catalyst support comprising a carbon prepared by polymerizing one or more polymerizable components from an aqueous solution, said polymer having pores whose

size primarily depends on the pH and water concentration of the solution, said pH and water concentration being controlled to yield an average pore size greater than 2 nm and a density greater than 0.1 g/cc; and pyrolyzing the porous polymer to form a porous carbon.

60. The mesoporous catalyst support according to claim 59 wherein said polymerizable components comprise a hydroxylated benzene and an aldehyde.

61. The mesoporous catalyst support according to claim 60 wherein said hydroxylated benzene is resorcinol and said aldehyde is formaldehyde.

62. The mesoporous catalyst support according to claim 59 wherein said pore size is between 10 and 28 nm.

63. A mesoporous sorbent comprising a polymer prepared by polymerizing one or more polymerizable components from an aqueous solution, said polymer having pores whose size primarily depends on the pH and water concentration of the solution, said pH and water concentration being controlled to yield an average pore size greater than 2 nm and a density greater than 0.1 g/cc.

64. The mesoporous sorbent according to claim 63 wherein said polymerizable components comprise a hydroxylated benzene and an aldehyde.

65. The mesoporous sorbent according to claim 63 wherein said hydroxylated benzene is

resorcinol and said aldehyde is formaldehyde.

66. A mesoporous sorbent comprising a carbon prepared by polymerizing one or more polymerizable components from an aqueous solution, said polymer having pores whose size primarily depends on the pH and water concentration of the solution, said pH and water concentration being controlled to yield an average pore size greater than 2 nm and a density greater than 0.1 g/cc; and pyrolyzing the porous polymer to form a porous carbon.

67. The mesoporous sorbent according to claim 66 wherein said polymerizable components comprise a hydroxylated benzene and an aldehyde.

68. The mesoporous sorbent according to claim 67 wherein said hydroxylated benzene is resorcinol and said aldehyde is formaldehyde.

69. The mesoporous catalyst sorbent according to claim 66 wherein said pore size is between 10 and 28 nm.